

Alabama, as everything else seems to grow there and I should also expect it in western Louisiana as it is in eastern Texas and southern Arkansas. I shall be glad of any light you can give me on this.

252

November 16, 1920.

I enclose a list of plants which are going to you by parcel post. The *Chamaecyparis* is an immense tree in Formosa and I hope it may prove hardy in Louisiana. The *Cunninghamia* is a new species from Formosa for which the Louisiana climate may be too cold. *Juniperus taxifolia* is a very fine Juniper from the Bonin Islands which has not before been cultivated. The *Quercus* is an evergreen species from Formosa. The *Picea* and *Pinus* are also Formosa plants.

The *Taiwanias* are the most interesting trees in this collection and I hope they will succeed in Louisiana. Will you send one of them to our friends at Avery Island?

You had best keep for your own garden the *Torreya* which is the Florida species and certainly ought to do well with you, and the *Gordonia*. *Nyssa Ogechee* is a very handsome tree which I do not think has ever been cultivated before and which I should think would succeed in any part of Louisiana. We have several more plants of this to dispose of and if you would like to have them and will send us another permit you shall have them.

I am delighted to hear that you are going to have a garden at Bay St. Louis and I think we shall be able to send you from time to time many plants for it.

253

November 26, 1920.

In this herbarium there is no Louisiana specimen of *Acer saccharinum* although some of the books say that it grows in Louisiana. It does not seem to be very rare in south central Mississippi and there would not seem to be any reason why it should not occur in eastern Louisiana. As it grows in southern Arkansas it would not surprise me to hear that it grows all over the state. We certainly should have specimens of it. According to Mohr it grows all over Alabama but we have no Alabama specimen, not even from Sardis! Help needed.

254

December 27, 1920.

I am much obliged for the specimen of the Silver Maple from the neighborhood of Alexandria. This is the only evidence I have that this tree occurs in Louisiana. I am surprised to hear that your [alleged] *Xanthoxylum* grows all over Louisiana as your specimen is a *Sorbus americana* which I had not supposed was found nearer Louisiana than the high mountains of North Carolina.

Did you know that Drummond found what we now call *Rhododendron serrulatum* in Louisiana? One of his specimens in the Gray Herbarium is labeled New Orleans. In Hooker's list of Drummond's Louisiana plants Covington is given as the station. This you know is the plant you found near Pearl River, and this is the only station we know for it in Louisiana unless you have found it in Covington or its vicinity. It might well be found in swamps anywhere in the coast region of eastern Louisiana. This and *Rhododendron canescens* are the only species we know in Louisiana. It would not surprise me, however, if you should find *Rhododendron oblongifolium* somewhere in the neighborhood of the Sabine River. This species is not rare in southern Arkansas and grows near Marshall and Houston in eastern Texas. I should think it would be worth looking for as another addition to the Louisiana flora.

With all good wishes for the New Year, I am,

255

February 1, 1921.

Ulmus americana flowered in Vermont April 19th, in Massachusetts, April 15–20. From Ohio, Florida and Arkansas there is no flowering specimen in this herbarium.

Salix nigra: Massachusetts, May 20–26; Ohio, May 8; Arkansas, April 8–22; Florida, March 24. No flowering specimen here from Vermont.

Acer rubrum: Vermont, April 23; Massachusetts, April 8–21; Ohio, March 27; Florida, only one specimen in flower here collected by Chapman and not dated; Arkansas, no flowering specimen.

This is in reply to your note of January 3rd. I do not know why you have asked for this information unless it was to expose the weakness of this herbarium.

There isn't much more, I fancy, for us to find out about Louisiana trees, so why don't you prepare a list of them with short notes on their distribution and habitat and we will publish it in the Arboretum Journal if it is not too long? This will make a good start on your catalogue of Louisiana plants.

256

February 4, 1921.

In this herbarium there is only one specimen of *Bumelia lycioides* and that was collected by you at Wakefield in West Feliciana Parish where you say on the label it is common. Do you know it from other parts of the state? I should expect it at Lake Charles and in other parts of West Louisiana as it gets into the coast region of eastern Texas.

I shall be obliged for any further light you can send me on this subject.

257

February 15, 1921.

Thanks for the information about the *Bumelias*. I am glad to hear that you will undertake the catalogue. I think it would be a good idea to put

in the time of flowering for the outside world does not know very much about the behavior of trees in Louisiana. I think there should be information of the frequency of the different species in different parts of the state and their places of growth. I suppose you have all the information.

In this herbarium there is no *Halesia* from Louisiana but *diptera*. Have you ever found anything else from within the state? *Carolina* appears to be common at Selma but there is nothing here from further west.

258

February 24, 1921.

Your *Ligustrum* is *lucidum* as you suppose. Sometime ago I wrote you that I thought a specimen of *Fraxinus* collected at New Orleans by Fendler in 1846 might be *F. pauciflora*. I now feel convinced, however, that it is *F. americana*. The handsomest trees of *Fraxinus americana* I have ever seen are those below Lake Charles along the river, the trees with slender pendulous branches and narrow leaves. We collected it in early spring. Have you ever collected fruit or mature leaves from these trees? They ought to be distinguished as a variety perhaps but I do not like to do it without better material. If you have never obtained fruit or mature leaves you ought to try and get them sometime in the future. This is certainly one of the handsomest of the Louisiana trees.

259

March 3, 1921.

If there were any specimens of *Viburnums* in the package with the *Ligustrum* they were overlooked in the unpacking. If you send others we shall hope to be more careful.

It looks like an early spring here but cold weather is predicted again and New England springs are not to be relied on.

260

March 14, 1921.

Of *Cephalanthus occidentalis* we have two Louisiana specimens in this herbarium, one collected by Palmer near Natchitoches and another in the neighborhood of Lake Charles by some collector I do not know. These are both the pubescent form, the var. *pubescens* of Rafinesque. We have no specimen here collected by you, and nothing whatever from east Louisiana where I suppose it is common; nor have we any specimen from the Selma region where I should be surprised if it were not common. I should be glad of more Louisiana material.

261

March 21, 1921.

Your *Viburnum* is, as you thought, *odoratissimum*. The Blackberry is *Rubus rosaeifolius* var. *coronarius*, the double-flowered form of the widely distributed Asiatic species. I am glad to know that this double-flowered

form is in cultivation in the United States and I wish you would dry flowering specimens for this herbarium where there is nothing to show that it is cultivated in this country.

The thermometer was up to 78 yesterday which means there will be a lot of damage done by frosts which are sure to come in the course of a week or two.

262

March 28, 1921.

I like your catalogue very much and am glad to get it. I see you include among the trees *Ilex lucida*, *Rhus glabra* and *Sambucus canadensis* which are not in the new Manual, probably by mistake. You omit *Aesculus Pavia* which certainly grows in east Louisiana where we saw the best specimen I have ever seen. *Vaccinium arboreum* var. *glaucescens* which grows about Shreveport is also omitted. I do not think there is any *Viburnum prunifolium* in Louisiana where *Viburnum rufidulum*, not in your catalogue, is common.

I am inclined to refer to *Acer saccharum* var. *glaucescens* your St. Francisville specimen 2520, May 15, 1915, my Des[s]ert Plantation, April 12, 1916, your Catalpa specimen 3170, April 15, 1919, and Palmer's Natchitoches specimen 7400, April 27, 1915. *Acer saccharum* var. *glaucescens* sometimes looks too much like *Acer floridanum*. Indeed all the Sugar Maples run together, and if there were not so many distinct varieties and forms it would be wise to consider them all as belonging to one species, but this would be very cumbersome in a book and hard to use.

I should like to know the exact range of *Avicennia* in Louisiana. We have no specimens from the state and should be glad to have them. I had supposed it was on some of the islands and not on the mainland. There is time to make corrections in this for the Manual.

A few of your names are not the ones we now use. I suppose you won't object to having your list similar to the Manual in this respect. Unless you object I will make the corrections and additions, and have the article set up and submit the proof to you.

We are having a very early season here and many things are blooming at least three weeks ahead of time. The severe frost which we are likely to get in April will do a great deal of harm I fear.

263

April 4, 1921.

Your *Ligustrum* seems exactly like the one we gathered early one morning on the campus at the University at Baton Rouge. At the time that specimen was referred to *L. coriaceum*, but the leaves are too thin and it seems best to consider that plant and yours received today *L. japonicum* in spite of the fact that the leaves of *japonicum* are more inclined to be acute.

I notice in your list of Louisiana trees you do not say anything about

Sapindus Drummondii from Tangipahoa, your No. 71 collected in June 1900. It is certainly that species and interesting as the only evidence we have here that *Sapindus Drummondii* grows east of the Mississippi River.

In the description of *Bumelia lanuginosa* I have adopted your statement that on the Louisiana seacoast, near the mouth of the Calcasieu River, it grows on the sandy beach as a shrub, forming dense thickets in a position where it is often covered by ocean spray. We have no specimen from this coast but I suppose there is no doubt of the species. We should like a specimen from there if you can spare it. Let me know at once if for any reason the statement should be eliminated from the Manual.

264

April 18, 1921.

I have been over your list of trees and sent it to the printer. You can expect a proof in the course of a couple of weeks or so.

You speak of *Malus coronaria* in East Louisiana. This of course is *Malus angustifolia* which also occurs in a rather pubescent form near Winnfield.

You speak of *Aesculus Pavia* as growing over the state. Is not this a mistake? My opinion is that it is confined to east Louisiana and that it nowhere crosses the Mississippi River. West of the river, so far as our collections here show, the red-flowered *Aesculus* is all *discolor* var. *mollis*.

You speak of *Oxydendrum* as growing in rolling woods over the state. Is not this a mistake? We have nothing to show here that it is in Louisiana outside of West Feliciana Parish where I think, like *Magnolia Fraseri*, it must find its southwestern home. If I am wrong about this and it does occur west of the Mississippi River please let me know by return mail as there is still time to make the correction in the Manual.

Is it possible that the Osage Orange may grow naturally in the extreme northwestern corner of the state. Have you ever fully investigated that region? Elsewhere in the state I feel sure that it must be naturalized.

265

August 7, 1921.

We have included your Washington Parish *Myrica* in the list of trees, for although there is no fruit it is evidently *Myrica inodora*. Although it grows as a shrub in Louisiana it is sometimes a small tree, and therefore properly finds a place in this list. It would be interesting to find other stations and obtain if possible fruiting specimens.

By all means let us publish the list of Louisiana shrubs and the sooner you get to work the better. I fancy it will be a harder task than the trees but it can be accomplished I think.

I haven't the slightest idea what "auto-intoxication" means. It does not sound like the right kind however. What you need is a change of air and scene, and why you don't come up here and pass a month or two with me this autumn I cannot imagine. The sea voyage would do you a lot of good and you would have the opportunity to work here on your Flora.

266

August 19, 1921.

Palmer is here and he and I have been carefully over your unplaced *Crataegus* material with the following results.

Palmer, Natchitoches, 9454, 8894, 8899, 7289, 7226 = *C. velutina*.

Crataegus species, low woods, West Lake Charles, C. S. S., March 23, 1917, = *C. pyracanthoides*, only known before from Mariana, Florida. I hope you will get fruit of this this autumn.

Bush, Minden, August 10, 1901, C. S. S., April 10, 1901, is *C. algens*. This is your No. 1008 of 1916.

Cocks, Crowley, 3326, 3327, April 14, 1920, *C. berberifolia*.

Natchitoches, Cocks, No. 20, April and September 1914, *C. Cocksii*.

Cocks, Crowley, 3331, *C. viridis*.

Cocks, Crowley, 3324, 3337, 3329, 3328, 3330, 3325, and Natchitoches 39, xii., xiii., xvi., is *C. edura*.

Palmer, Natchitoches, 7290 and 8722 seem to agree with *C. torva* which you have at Sardis.

This only leaves undetermined Bogulusa 3149, probably a new species of *Intricatae* and interesting as the only representative of that group from Louisiana. Fruit of this is needed. Can you get it this autumn?

Crus-galli species, Cocks, Pineville, xix., April 24, — Fruit of this is needed.

Pineville, *Crus-galli* species, April 5, 1912. Color of the anthers and fruit needed.

Viridis species with rose-colored anthers. A large tree in yard below Lake Charles collected by you and me April 21, 1907. Fruiting specimens with terminal shoots are needed.

Can't you clean these up as far as possible this autumn? Certainly there are now fewer undetermined species and specimens of *Crataegus* in Louisiana than in any other state. Of course there may be other species in the state which you haven't found yet but I do not believe there are many of them.

The proof of your article hasn't turned up yet, which is perhaps fortunate as the delay will enable me to insert these newly determined species in your list.

I hope you are well and getting through the summer comfortably.

267

August 25, 1921.

We have been looking over some of the Selma material and find a specimen of *Crataegus interior* Beadle, Harbison's No. 3, "along road to Professor Cocks's place, April 19, 1915."

Cocks 3242, Sardis, new species of *Bracteatae*. This is a very distinct and interesting looking plant in a small group with only two described species. I hope you can get fruit so that it can be named. To me this seems to be the most interesting of the Sardis species.

Cocks 827, April 11, 1912, probably *C. alabamensis*, but fruit is needed to make sure.

Harbison, Selma 2, April 19, 1915, and 58, April 12, 1917, are also probably *C. alabamensis* but we have no fruit.

Harbison, Sardis 1468, April 23, 1914, seems to be *C. ignava* but fruit is needed.

Cocks 831 and 834 may be *C. lacrimata* Small, but fruit is needed. As I have seen this species in Florida the branches are very pendulous. Is it so with your numbers?

268

August 30, 1921.

Your *Rosa humilis*, Natchitoches, July and October, 1913, and Palmer, Creston, 9428, April 18, 1918, with pubescent leaves is now called *R. Lyonii* Pursh. This species, if it is one, is widely distributed from Massachusetts to Missouri and Louisiana.

I wish this autumn you would send me for planting about a pint each of the nuts of *Carya leiodermis* and of *C. leiodermis* var. *callicoma*. As *Carya myristiciformis* seems to be hardy there is no reason why this other southern species might not be, and unless you get the nuts I do not suppose there is any one else now who could find the trees.

269

October 6, 1921

You have at last got page proofs of your acct of trees & I hope that it will now soon be published.

I have added Avery Island as a station for the Dahoon (*Ilex cassine*). We saw it by the lake with ripe fruit. I evidently failed to take a specimen & I suppose that you did as you do not mention it.

We have no La. specimen of this species in this herb. Can you let us have one.

I hope that you are all right again.

How about the shrubs? We are ready for them.

270

October 28, 1921.

I do not see any objection to your including in your list of shrubs those which are occasionally trees and which have appeared in the previous list. I suppose you will let us have a specimen of *Ilex* and *Amelanchier*.

Sorry to hear the *Crataeguses* have been behaving so badly this year. It certainly takes time and patience to get these things.

271

November 28, 1921.

I have at last found time to look over your last sending of specimens.

5001 can only be *Fraxinus americana* with unusually large fruit and with an obtuse wing.

5003 is *Viburnum scabrellum*.

5004 is *Ilex longipes* of Chapman. You collected the same thing in flower in the same locality and in several other places in the state where it appears to be common east of the Mississippi.

Ilex amelanchier is a good find for Louisiana. It is not very rare in Alabama but I have seen no specimen in Mississippi.

272

December 5, 1921.

Your list of Louisiana trees is in the April number of the Journal of the Arboretum which, owing to a printers' strike, has not yet appeared, although we have seen it in page-proof. This strike is very annoying. It has entirely demoralized the issues of the Journal, but the Manual is now promised for the middle of January.

Fraxinus Darlingtonii and *Fraxinus Smallii* exist only in the fertile brain of Dr. Britton.

With the compliments of the season,

273

December 13, 1921.

Palmer's *Rubus* 7431 is referred in the Flora of North America, which is published by the New York Botanic Garden, to *carpinifolius* Rydberg. The type of this species was collected near Alexandria. Palmer's 7208 is in the same work called *R. floridus* Rydberg. How good these species are you can judge as well as I can.

There are a number of distinct forms of *Rhus toxicodendron* in your part of the world and it was one of these which we collected at Shreveport. Nothing has ever been done in the way of separating this species into varieties but it certainly ought to be done. We have a large collection of them in the herbarium here.

The proper name of the *Ptelea* which we collected at Lake Charles is *P. trifoliata* variety *mollis* Torrey & Gray.

It seems a hard proposition to try and get any of Palmer's specimens from St. Louis for you. Palmer has talked about it several times and I have written. Palmer, who is working here this winter, will be in St. Louis in March and in half a day could pick out a set of herbaceous plants for you if he was permitted to do so. I do not know if this could be managed but it will do no harm to try. You certainly ought to have the plants and we made a mistake not to have asked Palmer to collect a special set for you and send them direct. I understand you have all the numbers of Palmer's woody plants.

With the compliments of the season, I am,

274

December 28, 1921.

Palmer's 9428 is a Rose. His *Vaccinium tenellum* number is 9429.

This number and his 9411 and 9469 we think are *Vaccinium vegetum*. We have no *V. corymbosum* from Louisiana, although it is said to grow there by Small. He also credits *V. fuscatum*, which is *V. corymbosum* var. *fuscatum* Gray, to Louisiana. We have one specimen of this from Texas. It only varies from *corymbosum* by the pubescent under surface of the leaves and by the pubescent branchlets. This variety grows in southern Georgia, and as it grows in Texas it might be expected in Louisiana, although we have no specimen from either Alabama or Mississippi. From Louisiana we have only one specimen of *V. tenellum*, your 4333 from Bayou Lacombe. We have no specimen of *Vaccinium myrsinites* from Louisiana.

It looks as if there was still a great deal of *Vaccinium* work to do in your state.

With all good wishes for the New Year,

275

January 11, 1922.

I have your package of *Vacciniums*.

3343, Fulton ?, is apparently *V. corymbosum*. All the others, Benton 3210 and 3207, Covington 1504, and Natchitoches 3202 are *V. virgatum* according to our understanding of that species.

I am glad to hear you are moving to Bay St. Louis which I am sure you will enjoy much more than New Orleans, and that you will have the opportunity for a good garden. In the spring we can contribute to it, if you say so, some Azalea and Camellia plants and possibly a few other things.

276

January 13, 1922.

Your *Crataegus* 966 and 3342 of September 19, 1915, and April 20, 1916, has twenty stamens. This seems a distinct and handsome new species of the *Bracteatae* group of which only two species have been described. The color of the anthers is not given. Can you get notes on them this spring or, if that is not possible, can you tell Harbison where this tree is growing? This is certainly your best *Crataegus* discovery and I am sorry *Crataegus Cocksii* is preoccupied. Will you suggest a name for it?

No. 7, Harbison, April 20, 1915, from the Sumner region we are referring to *C. blanda*.

Your Jasmine is the double-flowered form of *J[asminum] Sambac*.²³ This plant is widely cultivated in warm countries but I have not before seen specimens from the United States except from San Diego, California. It is of doubtful origin as to country and I think only the double-flowered form is known.

²³ Jasmines have long been favorites in French gardens; Nicholson mentions them for Santo Domingo in 1776 and Lelievrie, for New Orleans in 1838, but without specific names.

277

January 23, 1922.

Glad to hear about the color of the anthers of 3342. We have, I think abundant material of this with the exception of seeds which should be collected for planting. I hope you will invent a good name for it. Better send us a specimen of the plant which you have been calling *Jasminum Sambac* and perhaps we can help you. Certainly what you sent before is the *Sambac*.

My variety of *Quercus coccinea* with thickened cup-scales was based on plants from your place in Alabama. This was stated in my paper on *Quercus* in The Botanical Gazette, and if it were not easy to make mistakes I should be at a loss to understand why this fact was not brought out in the Manual.

So far as I have observed all the Scarlet Oaks in the Selma region which I saw had these thickened cup-scales.

Another mistake which has been pointed out to me is that Small and not Ashe is the authority for *Tilia floridana*, and I am feeling rather disgusted.

278

February 6, 1922.

I am describing Palmer's *Crataegus* 7234 and 8843, April and October 1915, from Natchitoches as *C. erioclada* and his 3719, September 1915, as *C. brachyacantha* forma *leioclada*.

The copy of the Journal with the Louisiana list of trees has arrived here this morning and I hope you will soon get your extras of the article. When you do I wish you would let us have one so that we can have it in this library as a separate.

279

February 17, 1922.

Crataegus erioclada is a new species, a description of which will appear in the next number of the Journal I hope.

I have no doubt there is a lot of collecting to be done along the Mississippi coast. I am glad to hear you are to undertake it.

280

March 1, 1922.

The omission of *Q[uercus] virginiana* might have got by you but I cannot imagine how it got by us here where the article and proof was certainly read times enough to prevent any such glaring omission. I think the best plan would be to add a note to your list of Louisiana shrubs making the correction. It would be more apt to be noticed there than if put by itself in the Journal.

How is the list of shrubs getting on[?]

281

April 21, 1922.

We were getting ready to send you next week the *Camellias* and other plants for your new garden when we discovered that it was necessary to get a permit from the Horticultural Inspector of Mississippi, and I am writing him today for one. This means I suppose that the sending of the plants will be delayed for at least a couple of weeks. It won't do any harm if you wrote to the Inspector yourself on the subject in the hope of hurrying him up.

You haven't suggested yet the name for that fine and very distinct *Crataegus* of yours from Selma.

We have a late spring here this year and last night had rather a heavy frost, but on the whole the Arboretum looks fairly well.

282

May 9, 1922.

I have now the permit from Mississippi to send you the plants for your garden and they shall go forward in the course of a day or two.

There is no specimen of *Calycanthus* in this herbarium from Louisiana or Mississippi and I did not know it extended as far westward. By all means send me all the material you can of your two species for this is now one of the genera we are especially interested in as there seems to be great confusion in the cultivated plants. For example, *Calycanthus floridus* which is supposed to be in every garden we cannot find cultivated anywhere in this country except in the Berckmans Nursery in Georgia where the yellow-flowered form is growing. In Alabama we know *Calycanthus floridus* only from Spring Hill near Mobile, Lookout Mountain, near Gadsden, and at Barclay. I am surprised it does not grow at Selma. Perhaps you will find it there.

How are you getting on with the catalogue of shrubs and aren't you coming up this summer to work here on your general catalogue? You certainly never can complete it without passing some time at the north, and what is the use of delaying your coming any longer?

283

May 23, 1922.

Your two specimens of *Calycanthus* seem to be the same, although the specimen from Bay St. Louis has remarkably narrow sepals. They appear to be forms of *fertilis nanus* and if this determination is correct it is remarkable to find them on the Gulf coast, for *fertilis nanus* has previously been known only from the mountains of North Carolina. I should have expected that you would have found in your region *C. floridus* which grows in the neighborhood of Mobile and is a southern species.

You ought to look further for *Calycanthus* for it is possible that you have other forms or species. It would be well to get fruiting specimens of the two plants of which you have sent the flowers.

I noticed that Small does not credit any *Calycanthus* to either Mississippi or Louisiana.

284

May 26, 1922.

I am interested in what you say about *Calycanthus floridus* in Louisiana and I hope we shall get a specimen of it from the state. I shall be glad, too, of one from the Selma region. There are two forms of *floridus*, one with much broader leaves than the other, and I am anxious to know which is the form which grows in Louisiana.

We have at last dispatched your plants to Bay St. Louis and I enclose a list of them. *Rhododendron Chapmanii* is not a plant with very showy flowers, but it is an interesting species found only close to the Gulf coast of west Florida. We had a many years' hunt for this plant which was originally discovered by Chapman and described by Gray. It should grow perfectly at Bay St. Louis.

I hope the *Juniperus taxifolia* will grow. It is a native of the Loochoo Islands and has not before been cultivated. There is a good chance, however, that it will prove hardy in Bay St. Louis.

There isn't much to say about the other plants which are going to you.

285

June 28, 1922.

We have received the list of Louisiana shrubs. *Act[a]ea alba* is no doubt included by mistake as it is certainly an herbaceous plant.

I still think *Rhododendron (Azalea) oblongifolium* must grow somewhere in western Louisiana as it is so common in Arkansas, eastern Oklahoma and eastern Texas. Don't you think you should look further for it in the valley of the Sabine River?

It seems to us very doubtful if *Philadelphus grandiflorus* grows naturally in Louisiana and I think your best plan would be to send us a specimen now of the plant which you say is often cultivated and sometimes naturalized in the state. No matter if the plants are out of flower if you haven't a spare specimen. Flowering sp[ecimen].

It is certainly very surprising that there is only one species of *Ribes* in the state. Does not *Daubentonia* die down to the ground every year? I had supposed it was herbaceous.

On the whole I am rather disappointed in the number of shrubs in Louisiana. Proportionately it is not as great as the number of trees. It would be surprising, however, if you or any one else have found them all.

286

July 1, 1922.

We have now examined critically your list of shrubs. I have already written you about *Philadelphus grandiflorus*. Rydberg gives Rapides Parish for *Rubus carpinifolius*.

Rosa Treleasei Rydberg. This species grows at Baldwin Bridge, Bossier Parish. The specimen is in the herbarium at St. Louis.

According to Rydberg *Amorpha tennesseensis* should be added to the list. You omitted entirely the *Rutaceae*, and *Acacia angustissima* collected by Palmer at Natchitoches. In the list *Cornus stricta* appears twice. One of these we think must be *C. asperifolia* as we have many specimens of that species from Louisiana where it appears to be generally distributed.

Azalea we now make a section of *Rhododendron*. What you call *Viburnum pubescens* is the large-leaved form of *V. scabrellum*.

The Vines, of which there are several species and genera, are omitted from this list. Don't you think they should be included as they are always considered to be shrubs? Will you supply us with a list of these and we will incorporate it?

287

August 8, 1922.

I hear for the first time from you of *Pinus Sondereggeri*. I feel very skeptical about its being a hybrid. Who named and published the tree? ²⁴ If it is possible to obtain this information and for us to see specimens at once there will probably be time to get some mention of the tree in your shrub paper which has now been in the hands of the printer for about two weeks. There would not, however, be any time to lose in getting the information. The fact that there appear to be a great many of these trees would tend to show that it was not a hybrid. *Pinus palustris* flowers so much earlier than *Pinus taeda* that it would be difficult for these species to hybridize. We should certainly see specimens.

It would surprise us here very much if *Cornus amomum* was found in Louisiana. We certainly have no specimen in the herbarium of this northern plant from Louisiana and if you have one I wish you would let us see it. For the time being at least we have omitted *Cornus amomum* from your list.

Gleditsia texana will have to be included among the Louisiana trees. I consider this now to be a hybrid ²⁵ and have referred to it the tree from Shreveport, Louisiana, from which I have collected specimens. Nuttall appears to have found it more than a hundred years ago near the mouth of the Arkansas River and we have a specimen which you sent from the Yazoo River, Mississippi, and one from southwestern Illinois.

If there is anything more to say about your paper it is not too late to do it. The proof of course will be sent to you as soon as we get it. The printer, however, is as usual very slow.

288

August 22, 1922.

We have submitted your mysterious Pine to Shaw who has made a critical examination of it and finds no trace of *Pinus palustris*, either in

²⁴ CHAPMAN, H. H. Jour. Forestry 20: 734. pl. 1. 1922.

²⁵ Cf. Jour. Arnold Arb. 3: 182, 206-207. 1922.

the cone or in the internal structure of the leaf. He pronounces it *Pinus taeda* and I feel sure that he is right. Of course we ought to know if possible if such a thing has ever been published, where and by whom. If the name is published it should become a synonym of *Pinus taeda*.

The principal things I want from you now are a few fruiting specimens of *Crataegus*, especially Sardis 3342, collected by you in flower April 12, 1919. This is the new species in the *Bracteatae* Group and I am particularly interested in it as only two other species are known. I am also anxious for fruit of the *Viridis* species with twenty rose-colored anthers growing in the yard of the house on the left hand side of the road along the river below Lake Charles. You remember the tree I am sure and how handsome it was. This also is possibly undescribed.

We have from you two *Crus-galli* species from Pineville, one collected April 1912, without any number, and the other numbered XIX., April 24, no year. We ought to have fruit of these two trees. No color of the anthers unfortunately is given with the specimens. Have you got it? Fruit of Bogalusa 3149, April 9, 1919, a *Viridis* species, is also needed.

Bogalusa 3151 is a species of the *Pulcherrimae* apparently undescribed if you are sure of the color of the anthers. The flowers on our specimen are pretty much faded and the color may have changed. This is interesting as the only *Pulcherrimae* we know of in Louisiana. Do you remember anything about the size and habit of the plant and have you any other notes on the color of the anthers?

This is all the undescribed Louisiana material we have and if you have everything there is the *Crataegus* material of Louisiana is better worked up than that of any other state. You can add to the Louisiana trees *C. blanda* Sargent, Minden, Bush No. 663, August 10, 1901. This is a *Viridis* species with very dark scaly bark. I think we looked at this from trees growing near *C. aestivalis* but I do not find that I made any specimen.

I am most interested now in the Sardis 3342 and in the St. Charles *Viridis* species. I hope you will certainly be able to get them and possibly the Pineville and Bogalusa material. Of the latter it would be better to get more material of 3151.

289

November 7, 1922.

In your catalogue you mention a Catalogue of the Plants of Southern Louisiana by the Reverend Langlois. We have n't a copy of this. Can you get one for us?

Can you give a locality for *Hypericum lobocarpum* as being near Louisburg, St. Tammany Parish? We cannot find this name in the atlas and are therefore omitting it. In this herbarium there is no specimen of *Hypericum lobocarpum* from Louisiana. Can you let us have one?

I am afraid your entry of the American *Ampelopsis* is incomplete. There is no specimen of the typical plant here but specimens of two varieties. We ought to have better material of this plant in this herbarium. We have

decided to leave out any reference to the type and put in the two varieties represented in this herbarium.

It is too late to send you the page-proof as I hope the article will now be printed in a short time. We have done the best we can with it but I daresay there are still some omissions.

Can't you get for me a quart of acorns of *Quercus virginiana*? I want to send them to a correspondent in South Africa where exotic trees appear to do better than in any other part of the world. Before sending it would be best to put the acorns in water and send only those which float; those which sink will have grubs in them. It will be best to send them in a box of soil as acorns lose their germinating power very quickly.

Are you going to be able to get me the nuts of *Carya leiodermis* and its variety *callicoma* this autumn? I very much want to plant them here in the hope that the trees will prove hardy.

290

December 26, 1923.

I owe you an apology for the long delay in answering your letters of October 24th and 29th in regard to various specimens of Hickories sent at that time.

You say that No. 1 which you call *leiodermis* is the only one you recognize. No. 2 is clearly the same thing. I think these trees cannot be referred to *leiodermis*. The branchlets and leaves are much too pubescent as I understand that species. We are putting the specimens among the undetermined ones and I hope you will follow these trees up in the spring; as I understand them now they do not fit into any of the described species. Nos. 3 and 4 are *C. glabra* [var.] *megacarpa* which is a common species along the Gulf coast.

Carya ovalis [var.] *obcordata* from West Feliciana seems to me to be rightly determined. Apparently we did not know this tree from Louisiana before and it is certainly some way beyond its known range; it is a good find.

Your *Betula* from West Feliciana is a very pubescent but not uncommon form of *Betula nigra*. We shall be glad of one of your specimens of *Oxydendron* from the Natchitoches region.

I am very sorry indeed to hear that that beautiful *Crataegus* from south of Lake Charles has been cut down before we had an opportunity to describe it. You ought to be able, however, to find others in that region. I hope you are not going to give up that Selma species which is one of the most interesting of all your *Crataegus* discoveries.

Castanea alnifolia [var.] *floridana* is not that species but probably a form of *Castanea pumila*.

Here we have so far had a very mild winter with a green Christmas. Once only the thermometer has been as low as 18 and there has been no snow yet to speak of. I trust you are equally fortunate in your part of the world.

With all good wishes for the New Year, believe me,

291

February 24, 1925.

Please excuse me for the long delay in answering your letter of February 5th about tree surgery as practiced by Davey. I am a disbeliever in it.

In the first place it is very expensive, and when a cavity is filled with cement it is impossible to prevent moisture forming between the surface of the wood and the cement. This brings on decay and many trees have been destroyed in this way. Davey and his system are the produce of extreme advertising. The only way to treat a cavity in a tree is to clean out thoroughly all decayed wood and then keep the surface painted with tar, leaving the cavity open so that what is going on can be watched. Of course the tar will have to be renewed from time to time. Sometimes a very old tree is so far gone that it is better to cut it down and replace it by a young one.

I hope you are well this winter and enjoying life, and that you are preparing to come north next summer and do some serious work here on your book.

We have had a very bad winter for plants — no snow, extreme drought and some very cold weather. I am afraid there will be many losses in the Arboretum before spring really comes.

292

March 2, 1925.

Sudworth has published in last year's Journal of Forestry (our copy now unfortunately in the hands of the binder) *Carya Ashei*, distinguished by 7–9 leaflets and remarkably long stigmas. I have seen the type plant from Pensacola, Florida, the only one which has been collected apparently with pistillate flowers. One leaf of this tree has nine leaflets; all the others have only seven. I do not think it is safe to establish species on such scanty material. To me it seems to be a variety or form of *Carya ovalis*. The species, as you know, extends along the Gulf coast to southern Mississippi and Louisiana in some of its forms. I wish you would look out for such a tree this spring when the Hickories are in flower and see if you can find any of them with nine leaflets, or what is more important the exceptionally long stigmas.

I suppose it begins to be a little springlike in your part of the world. Here it is cold, dry and generally disagreeable, with a prospect of a good deal more winter before us.

With kind regards,

293

March 7, 1925.

We have all been looking again at your Hickory from Bay St. Louis. Judging from the leaves I do not think there can be any doubt that it is *Carya alba*. It is unusual in the thinner husk of the fruit and in the less pointed, strongly angled and paler nuts. The nuts of this species are

very variable, and I think we can match yours almost exactly from among Palmer's collections west of the Mississippi. I should like to know how the bark looks. Would it not be possible to get a photograph of a trunk to go with your specimens?

I am sorry to hear there are more *Crataeguses* to find but I am not surprised.

It is acting now like an early spring but I suppose we shall have a lot more snow. It is still terribly dry and during this week the thermometer has been down to 10 above zero.

294

July 1, 1925.

Your *Amelanchier* from Alabama is a common northeastern species, *A. intermedia* Spach, but it appears to have been more or less cultivated at one time in the southern states for its fruit.

There are no mosquitos yet in this part of the world and the best thing for you to do is to come up to New England and pay us a summer visit.

You do not say anything about your Louisiana Flora. Are you still working on it and, if so, how is it getting on?

I wish I heard from you oftener, and I much want to see you again but I am afraid I shall never get as far from home as Louisiana. You must come up and see me.

295

August 19, 1925.

I am not sure that I ever answered your note of June 27th in which you ask about a small shrubby *Amelanchier* in Alabama which grows you say in a few places near Selma.

The name of the species is *Amelanchier intermedia* Spach.

I fancy there are still hybrid Oaks and Hickories to find in Louisiana.

You must certainly come up and see the Arboretum sometime. There are few mosquitos here just now and on the whole this has been a wonderful summer, and the Arboretum has never before looked so well at this season.

296

September 11, 1925.

I am working over a paper to be published in the Arboretum Journal giving a list of errors which occurred in far too great numbers in the second edition of my Manual of Trees of North America, and if you have noticed any mistakes I wish you would call my attention to them. There are misspellings of geographical names and many errors in distribution; the latter are the most important, and I should especially like to know of any of these relating to Louisiana trees.

With kind regards, I am,

297

October 22, 1925.

Glad to get your note of the 18th. The separates will be sent to you soon.

I do not believe you dislike clerics more than I do but I cannot help feeling sympathy, as I wrote you, for the unfortunate old Bishop from Arkansas.

I hope you will send us a specimen of the Oak from Bay St. Louis.

We have no record here that *Raphidophyllum hystrix* grows in Alabama and of course we should be glad to get a specimen from there.

298

December 30, 1925.²⁶

I am distressed at the news conveyed about your health in your note of the 17th of December. I can only hope that your views of the future are not as bad as you state. I wish there was something I could do for you or send you, and if you will only intimate something you would like, some book perhaps to read, you shall have it if I can procure it for you. I really cannot tell you how badly I feel. Of course you will be out again in the spring.

I am still fairly well and getting to the Arboretum every day but am too old to enjoy life.

As I hope you know, I am,

Always sincerely and devotedly yours,

299

January 11, 1926.

I am certainly sorry that you will not be able to meet Dr. Councilman for he is a delightful and learned man, and has a charming wife. Moreover, he has become much interested in plants, especially in the study of peculiar fungous growth on the roots of Oak-trees. I am sorry to say he has not sent me his New Orleans address but if you have it I hope you will write to him.

You have asked me about thrilling novels which is one of my specialties, and I will see in future that you are well supplied with them. I have already sent you three or four and others will follow. I shall feel that I have n't lived in vain if I have introduced you to "Nick Carter,"²⁷ the most thrilling of all, and among the long series certainly are some of the best detective stories which have ever been read.

Let me hear occasionally if you get any pleasure from the books I send you and I hope that your health is improving.

²⁶ Addressed to Professor Cocks at Bay St. Louis, Mississippi, where he had moved that year.

²⁷ Fictional character in dime novels fathered about 1885 by J. R. Coryell (?) but publicized in any event by Street and Smith, New York, producers of over 1000 stories about him by several authors.

300

January 27, 1926.

I have n't heard a word from Councilman since he reached your part of the world, but I have heard of his visit to Natchez through Miss Comp-ton and that he is now laid up in bed in New Orleans and obliged to postpone starting for Havana. I am afraid he has n't been able to see you which I greatly regret for he is a delightful person.

As you are a Britisher and no doubt a tea-drinker I am sharing with you some tea sent me by J. P. Morgan which has a remarkable reputation. I cannot vouch for this personally as I never drink tea. I believe it is better with lemon than with milk. If you don't like it there are probably plenty of people to whom you can give it.

I hope you are getting on better and that I shall hear from you again before long.

With kind regards,

301

March 19, 1926.

I find in our herbarium we have a *Crataegus uniflorae* species with very small flowers collected by Harbison April 19, 1911, and labeled "C. uni-flora at Professor Cocks's along road in the woods." Have you ever col-lected any fruiting specimens of this plant and do you know anything about it? I am not quite sure what he means by your place, whether it was in Mississippi or at Sardis, Alabama, where you seem to have collected a good deal. We have a specimen collected by you there on April 2nd, 1919, in flower (No. 3342) with twenty stamens and yellow anthers. What is this? Have you a fruiting specimen? This may be undescribed. We also have complete fruiting material of a *Flavae* species (No. 968) col-lected in 1915 and 1916 at Sardis. Do you know anything about this?

We are trying here with much difficulty and not much success to arrange a lot of unplaced *Crataegus* material and badly need help.

I hope that you are improving and able to enjoy the spring which is now probably upon you. It is still wintry here with the ground covered with snow.

With kind regards and all good wishes,

302

November 1, 1926.

The *Crataegus* No. 4126 from Chestnut, Louisiana, appears to be with-out doubt *Crataegus drymophila* Sargent.

Faithfully yours,
/s/ C. S. Sargent

INDEX TO PERSONAL NAMES WITH BIOGRAPHICAL DATA

(Numbers refer to the letters not to pages)

- ADAMS, THOMAS WILLIAM (1842-1919), arboriculturist of Greendale, Canterbury, N.Z., 144
- ALLISON, ANDREW (1879-1960), amateur naturalist of New Orleans and for 40 years missionary to China, particularly interested in birds, 58
- AMES, OAKES, (1874-1950), orchidologist, Research Professor of Botany, at one time supervisor of the Arnold Arboretum and later director of the Botanical Museum, Harvard University, 115, 143, 203
- ASHE, WILLIAM WILLARD (1872-1932), botanist and forester, United States Forest Service, particularly interested in *Crataegus*, 105, 158, 164, 277
- BALL, CARLETON ROY (1873-1958), agronomist, authority on American *Salix*, who joined the U. S. Division of Agrostology in 1898, and from 1918 to 1929 was in charge of Division of Cereal Crops and Diseases, 192
- BARTRAM, WILLIAM (1739-1823), son of pioneer American botanist JOHN BARTRAM, and himself an explorer-naturalist who visited Louisiana in 1775 and published his *Travels* in 1791, 7
- BEADLE, CHAUNCEY DELOS (1866-), forester, son of a nurseryman of St. Catharines, Ontario, who went to Biltmore, N. C., in 1900 to manage planting operations on the estate of GEORGE W. VANDERBILT; became a student of *Crataegus*, 18, 156
- BERCKMANS, PROSPER JULIUS ALPHONSO (c. 1830-1910), Belgian-born "Georgia horticulturist," assisted CHARLES and A. J. DOWNING in revision of their *Fruits and Fruit Trees of America*, and whose nursery "Fruitlands" near Augusta served the South, 282
- BLARINGHEM ("BLARENINGHAM" of the letters), LOUIS (1878-), French botanist, geneticist, at one time member of Pasteur Institute of University of Paris, 203, 208
- BOSC, LOUIS AUGUSTIN GUILLAUME (1759-1828), French naturalist who visited the Carolinas, 1798-1800, author of a treatise on oaks, 189
- BRITTON, NATHANIEL LORD (1859-1934), American botanist, the "Great Britton," first director of the New York Botanical Garden, who launched its field studies of neotropical floras, 42, 175, 231, 237, 272
- BUCKLEY, SAMUEL BOTSFORD (1809-1883), naturalist and collector, who travelled in Georgia and was twice State Geologist of Texas, 109
- BUSH, BENJAMIN FRANKLIN (1858-1937), botanist, settled in Independence, Missouri, in 1865, and in 1893 exhibited a collection of plants of the state at the Columbian Exposition, 25, 73, 168
- BUTLER, EDWARD, and wife, of Catalpa, West Feliciana Parish, hosts to many botanists at their plantation where there was once a hothouse three stories high in which pineapples ripened and many exotics flourished, 25, 168, 200
- CARPENTER, WILLIAM MARBURY (1811-1848), physician, botanist, professor, taught at Centenary College, Jackson, West Feliciana Parish, and at University of Louisiana, New Orleans, for whom TORREY and GRAY named the genus *Carpenteria*, 22, 140
- CHAPMAN, ALVAN WENTWORTH (1809-1899), botanist, physician, who arrived in Georgia in 1831, and finally, in 1847, settled in Apalachicola, Florida, where he practiced medicine for more than fifty years, 255
- COMPTON, CHARLES CROMARTIE, of Natchez, where she was affectionately known as "Miss Charlie," and "who greatly aided the Arboretum by gathering material of the woody plants of Adams County, Mississippi" (Sargent), for whom *Quercus comptonae*, "one of the handsomest American oaks," was named, 118, 300
- CONARD & JONES, nurserymen, of West Grove, Pennsylvania, dating (as Dingee & Conard) from 1862, and in about 1892 organized by ALFRED FELLEBERG CONARD (1835-1906) and S. MORRIS JONES as a pioneer mail-order business, 227
- COUNCILMAN, WILLIAM THOMAS (1854-1933), pathologist, professor at the Harvard

- Medical School from 1891, member of Hamilton Rice Amazonian Expedition to study tropical diseases, 299, 300
- DAVEY, JOHN (1846–1923), tree surgeon, whose *Tree Doctor* (1902) established his campaign for tree care, 291.
- DAWSON, HENRY SARGENT, son of JACKSON DAWSON (1841–1916), superintendent of the Arnold Arboretum, 155
- DODSON, WILLIAM RUFUS (1867–), forester, author of a brochure distributed at Louisiana Purchase Exposition, St. Louis, 1903, on Louisiana forests and timber woods, 5
- DRUMMOND, THOMAS (1790–1835), ardent Scottish botanical explorer in western Canada, Texas, and southeastern United States, whose exsiccatae were sold to subscribers by WILLIAM JACKSON HOOKER, 119, 169, 189, 230, 231, 246, 254
- DUNCAN, STEPHEN (1787–1867), physician, who came to Natchez in 1808, became president of the Bank of Mississippi and created "Duncan's Park," 118
- ELWES, HENRY JOHN (1846–1922), F. R. S., arboriculturist, Victoria medallist, educated at Eton, world traveller, author of *A Monograph of Lilium*, and with A. HENRY of *The Trees of Great Britain and Ireland*, 200, 202, 204, 205, 208, 210
- FAXON, CHARLES EDWARD (1846–1918), botanist, artist, who, Sargent said, drew more analytical sketches of trees than any other botanical draughtsman; from the first drawing in 1882 he completed 744 plates for the *Silva* in just twenty-one years, 23
- FENDLER, AUGUST (1813–1883), German-American botanical explorer of New Mexico (cf. ASA GRAY's *Plantae Fendlerianae Novi-Mexicanae*, 1849), Venezuela, Panama, and Trinidad, 231, 258
- FERNALD, MERRITT LYNDON (1873–1950), distinguished American botanist, Fisher Professor of Natural History and Director of the Gray Herbarium, Harvard University, long editor of and contributor to *Rhodora*, author of eighth edition of *Gray's Manual of Botany*, 54
- GRAY, ASA (1810–1888), Fisher Professor of Natural History at Harvard, from 1842, most prominent American botanist of the nineteenth century, author and critic, 186
- HALE, JOSIAH (c. 1791–1856), physician and botanist of Alexandria, Louisiana, and later of New Orleans, 140, 192, 246
- HARBISON, THOMAS GRANT (1862–1936), collector for the Arnold Arboretum, 36, 37, 41, 45, 52, 55, 58, 78, 81, 84, 86, 92, 93, 96, 97, 99, 103, 107, 114, 118, 121, 124, 125, 128, 132, 135, 140, 156, 161, 170, 188, 192, 202, 218
- HARPER, ROLAND McMILLAN (1878–), veteran botanist of Alabama, author of a *Phytogeographical Sketch of the Altamaha Grit Region of the Coastal Plain of Georgia* (1906), to which SARGENT referred, 39, 133
- HEDRICK, ULYSSES PRENTISS (1870–1951), horticulturist, special student of fruit crops, 40
- HOOKE, WILLIAM JACKSON (1785–1865), distinguished British botanist, first at Glasgow, then for 24 years director of the Royal Botanic Gardens, Kew, who described DRUMMOND's plants from America, 230
- KING, GRACE ELIZABETH (1851–1932), author of *Creole Families of New Orleans*, etc., born and educated in that city, "she became a symbol of its culture, the best representative of the city's charm and hospitality." Professor Cocks gave a speech, "The Fiction of Grace King," at a memorial dinner (La. Hist. Quart. 6: 353–359. July, 1923), 242
- LAMB, WILLIAM HARRISON, forester, 42
- LANGLOIS, AUGUSTE BERTHELEMY (1832–1900), botanist-priest of Point-a-la-Hache, Plaquemines Parish, and St. Martinsville, St. Martin Parish, particularly interested in fungi and mosses, and author of *Catalogue provisoire de plantes phanérogames et cryptogames de la Basse-Louisiane, États-Unis d'Amérique* (1887), 289
- LEAVITT, —————, landscape gardener, 226
- LETTERMAN, GEORGE WASHINGTON (1841–1913), teacher in public schools of Allenton, Missouri, who botanized principally in that state but also in the southern states and the Rocky Mountains, and for whom SARGENT named a *Crataegus*, 140

- LOVELL, PHEBE SUSAN (MRS. PRESTON SPENCER LOVELL), of Crowley, Louisiana, amateur botanist, for whom Professor EZRA BRAINERD named *Viola lovelliana*, 241
- MARSHALL, SAMUEL, superintendent of Audubon Park, New Orleans, 47
- MATTOON, WILBUR REED (1876-1941), forester, 133, 144
- MCILHENNY, SARAH AVERY (1860-1948), oldest sister of EDWARD AVERY MCILHENNY (1872-1949), naturalist of Avery Island, Louisiana, etc. 89, 93, 136
- MOHR, CHARLES THEODORE (1824-1901), German-born botanist, who accompanied AUGUST KAPPLER to Dutch Guiana as botanical collector, lived in Cincinnati, Ohio; California (as a '49er); Indiana; St. Louis, Missouri, and in Mexico, and for more than forty years was a pharmacist at Mobile, Alabama, author of *Plant Life of Alabama*, 8, 113, 124, 133, 253
- MOORE, ———, collected at Mt. Vernon, Alabama, 195
- MORGAN, HENRY GIBBES (1843-1925), president of Audubon Park Commission, New Orleans, 47
- MORGAN, JOHN PIERPONT (1867-1943), New York banker, son of famous banker of the same name, 300
- NASH, GEORGE VALENTINE (1864-1921), agrostologist, head gardener at New York Botanical Garden, who collected in Florida, 119
- NEALE ("NEAL" of letters), HAROLD J., "general superintendent and landscape architect," Audubon Park, New Orleans, 160
- NESS, HELGE (1861-1928), horticulturist, Texas Experiment Station, College Station, Texas, interested in plant hybrids, 155, 156
- NUTTALL, THOMAS (1786-1859), English-American naturalist, at one time Curator of the Botanic Garden at Harvard University, who twice visited New Orleans, author of *The North American Sylva*, 16, 54
- PALMER, ERNEST JESSE (1875-1962), field collector for 35 years for the Missouri Botanical Garden and the Arnold Arboretum, 66, 71, 73, 75, 82, 86, 87, 93, 94, 97, 98, 101, 103, 109, 111, 114, 117, 124, 128, 130, 137, 141, 167, 225, 230, 266, 273
- RAFINESQUE, CONSTANTINE SAMUEL (1783-1840), eccentric naturalist, born near Constantinople of French and German parents, who taught botany and modern languages at Transylvania University, and wrote on banking, history, shells, and fishes, but especially on plants, including *Florula Ludoviciana* (1817), 64
- REHDER, ALFRED (1863-1949), Associate Professor of Dendrology, Harvard University and curator of the herbarium of the Arnold Arboretum, author of *Manual of cultivated Trees and Shrubs hardy in North America*, 13, 32, 34, 140, 237, 238, 242
- [RICHARDSON, IDA ANN SLOCUM (d. 1910), second wife of Dr. TOBIAS GIBSON RICHARDSON, Dean of Tulane School of Medicine, 1865-1885, both were world travellers and amateur horticulturists, 242]
- RIDDELL, JOHN LEONARD (1807-1865), physician, chemist, botanist, for the last thirty years of his life a resident of New Orleans, author of *Catalogus Florae Ludoviciana*, published in the New Orleans Medical and Surgical Journal in 1852, 22, 161
- RIDGWAY, ROBERT (1850-1929), distinguished American ornithologist, curator of birds in the United States National Museum for over fifty years; spent his later years at Olney, Illinois, where he preserved a tract of virgin hardwood forest, 247
- ROBIN, CLAUDE CESAR (1750-), author of *Voyages dans l'interieur de la Louisiane* (Paris, 1807), which contained the first botanical resumé for the state, "Flore Louisianaise," in the third volume, published in modified English form ten years later by RAFINESQUE, 35
- ROBINSON, BENJAMIN LINCOLN (1864-1935), American botanist, Asa Gray Professor of Botany at Harvard, first editor of *Rhodora*, brother of JAMES HARVEY ROBINSON, historian, 186
- [SARGENT, ANDREW ROBESON (d. 1918), son of CHARLES SPRAGUE SARGENT, 169]
- SCHENCK, J. S., forester who collected type of *Quercus schenckiana* Trel. in Mexico in 1898, but not to be confused with JACOB SCHNECK (1843-1906) for whom *Q. schneckii* Britt. was named, 42

- SHAW, GEORGE RUSSELL (1848–1937), author of a handbook of knots and splices, and a monograph, *The Genus Pinus*, 288
- SHUMARD, BENJAMIN FRANKLIN (1820–1869), competent state geologist of Texas, removed in 1860 by Gov. SAM HOUSTON, commemorated by S. B. BUCKLEY in *Quercus shumardi*, 109
- [SLAUGHTER, (Mrs.) MARY MARBURY, of Ruston, Louisiana, niece of W. M. CARPENTER, 22]
- SMALL, JOHN KUNKEL (1869–1938), American botanist, associated with the New York Botanical Garden for a lifetime, author of *Flora of Southeastern United States* (1903) and *Manual of the Southeastern Flora* (1933), 2, 39, 46, 56, 87, 108, 140, 166, 186, 277, 283
- SUDWORTH, GEORGE BISHOP (1864–1927), chief dendrologist, United States Forest Service, author of *Forest Trees of the Pacific Slope*, 292
- TRACY (“TRACEY” of the letters), SAMUEL MILLS (1847–1920), agronomist, resident of Biloxi, Mississippi, who collected in southern and western states, 17, 30, 138, 246
- TRELEASE, WILLIAM (1857–1945), American botanist, director of Missouri Botanical Garden, 1889–1912, monographed *Agave*, *Quercus*, *Phoradendron*, and *Piper*, 188
- WIEGAND, KARL MCKAY (1873–1942), professor of botany, Cornell University, author of a revision of *Amelanchier*, etc., 228
- WILSON, ERNEST HENRY (1876–1930), English-American botanist, plant explorer in China — “Chinese Wilson” — Japan, Korea, and Formosa, author of horticultural books, assistant director of the Arnold Arboretum, 1919–1926, keeper, 1927–1930, 100, 217

INDEX TO PLANT NAMES

(Numbers refer to the letters not to pages)

- Acacia angustissima*, 286
Acanthopanax, 1
Acer, 87
 drummondii, 46, 54, 56, 195, 199
 floridanum, 36, 37, 38, 52, 93, 194, 197, 236, 262
 leucoderme, 29, 37, 38, 52, 118
 negundo, 54
 var. *texanum*, 193
 nigrum, 37, 38, 201, 202
 rubrum, 201, 255
 var. *drummondii* forma *rotundata*, 195, 199
 var. *tomentosum*, 195, 199, 209
 var. *tridens*, 195
 saccharinum, 253
 saccharum, 93, 194, 236
 var. *glaucescens*, 262
 var. *glaucum*, 194, 236
 tridens, 199
Actaea alba, 285
Adelia, 242, 243
Aesculus austrina, 4
 discolor var. *mollis*, 264
 pavia, 5, 23, 38, 262, 264
 splendens, 30, 38
Alder, 48
Amelanchier, 120, 228, 270
 canadensis, 225
 var. *tomentula*, 11
 intermedia, 294, 295
 sanguinea, 59
Amorpha tennesseensis, 286
Ampelopsis, 289
Apple, 13, 24, 26, 49, 55
 crab-, 41
Araucaria, 45
Aronia, 230, 231, 240
 arbutifolia, 230
 var. *macrophylla*, 243
Ash, 90, 240
Asimina parviflora, 11
 pubescens, 11
 triloba, 123
Avicennia, 262
 nitida, 33
Azalea, 59, 180, 183, 185, 239, 240, 241, 242, 275, 286
 canescens, 239
 ledifolia, 240
 nudiflora, 180, 183, 239
 serrulata, 239
 viscosa, 185, 187, 239
Beech, 119
Betula nigra, 290
Blackberry, Highbush, 19, 53
Bumelia, 146, 257
 cassinifolia, 140, 238
 lanuginosa, 4, 263
 lucida, 140, 166
 lycioides, 44, 140, 256
Calycanthus, 282
 fertilis nanus, 283
 floridus, 282, 283, 284
Camellia, 275, 281
Carya, 36, 67, 75, 82, 163
 alba, 36, 55, 57, 65, 68, 69, 74, 86, 89, 117, 121, 131, 139, 146, 150, 152, 154, 155, 169, 173, 293
 arkansana, 60, 65, 72, 74, 75, 85, 117, 139, 173
 ashei, 292
 buckleyi var. *arkansana*, 173
 callicarpa, 146
 callicoma, 84, 85, 139, 142, 173
 carolinae-septentrionalis, 92, 93
 cordiformis, 36, 48, 70, 72, 172, 186, 212
 glabra var. *megacarpa*, 290
 laciniosa, 48, 178, 179, 182, 184
 leioderms, 68, 142, 146, 173, 174, 179, 180, 186, 268, 289, 290
 var. *callicoma*, 173, 268, 289
 leucoderms, 139
 megacarpa, 55, 65, 68, 74, 117, 139
 var. *stellipila*, 68, 74, 186
 myristicaeformis, 48, 268
 ovalis, 55, 65, 139, 292
 var. *obcordata*, 290
 var. *subglobosa*, 74, 75, 146
 ovata, 48, 55, 68, 139, 179, 180
 var. *nuttallii*, 48
 pallida, 48, 55, 84, 121, 152, 156, 172, 179
 pecan, 179
 porcina, 55, 65
 texana, 49, 63, 65, 179
 tomentosa var. *subcoriacea*, 182
Castanea alnifolia, 202, 215
 var. *floridana*, 210, 220, 290
 floridana, 215

- nana*, 202
pumila, 76, 79, 210, 225, 290
Celtis, 188
 crassifolia, 194
 georgiana, 167, 190, 194
 laevigata, 189, 190, 192, 199
 mississippiensis, 189, 192, 200
 occidentalis, 194, 199, 212
 var. *crassifolia*, 191, 212
 pumila, 167, 212
Cephalanthus occidentalis var. *pubescens*, 260
Cephalotaxus japonica, 11
Cercis canadensis, 58
Chamaecyparis, 252
Cherry, 41
Chrysobalanus oblongifolius, 208
Citrus, 102
 Chinese, 100
 ichangensis, 100, 102
Cocculus laurifolius, 242
Cornus amomum, 54, 287
 asperifolia, 286
 obliqua, 54
 purpusi, 54
 sericea, 54
 stricta, 286
Crataegus, 5, 18, 20, 22, 24, 25, 27, 32, 34, 38, 73, 82, 105, 130, 152, 168, 185, 186, 187, 202, 203, 205, 209, 233, 266, 281, 288, 290
 abbita, 168
 aestivalis, 73, 168, 229, 288
 alabamensis, 267
 albicerca, 156
 algens, 227, 266
 apiifolia, 34, 234
 aprica, 130
 arborescens, 11
 araioclada (*eriodlada*), 278, 279
 berberifolia, 18, 266
 blanda, 276, 288
 brachyacantha, 18, 20, 27, 34, 55, 168
 forma *leioclada*, 278
 Bracteatae, 267, 276
 bushii, 168, 224
 coccinea, 156
 cocksii, 227, 266, 276
 constans, 227
 crocina, 156
 Crus-galli, 18, 34, 38, 73, 168, 170, 171, 266, 288
 drymophila, 241, 302
 edita, 18, 168, 224
 edura, 73, 156, 266
 enucleata, 168
 eriodlada, 278, 279
 fera, 168
 Flavae, 168, 169, 170, 205
 ignava, 267
 interior, 267
 Intricatae, 266
 lacrimata, 267
 opaca, 168, 169, 229
 penita, 224
 pruinosa, 73
 Pulcherrimae, 288
 pyracanthoides, 266
 silvicola, 18, 34, 168, 241
 spathulata, 11, 34, 232, 235
 tersa, 34, 73, 156
 tomentosa, 99, 102
 torva, 227, 266
 uniqua, 168
 velutina, 73, 168, 266
 viridis, 27, 34, 38, 168, 209, 224, 266,
Cunninghamia, 252
Cupressus funebris, 47
Cyrilla parvifolia, 56

Dahoon, 269
Daubentonia, 285
Desmodium, 31
Dewberry, 20
Diospyros, 6, 8
 virginiana, 250
Dirca palustris, 241

Elm, slippery, 91
Epigaea repens, 89
Erythrina herbacea, 31
Euonymus americanus, 20
 atropurpureus, 251

Fagus grandifolia, 119
 forma *pubescens*, 119
 var. *caroliniana*, 119
 forma *mollis*, 119
Fraxinus americana, 212, 258, 271
 caroliniana, 233
 darlingtonii, 231, 237, 238, 272
 floridana, 231
 michauxii, 42
 pauciflora, 231, 258
 pennsylvanica, 231, 237
 var. *lanceolata*, 212, 233
 profunda, 42
 smallii, 237, 272
Fungus (on oak roots), 299

Gaylussacia hirtella, 209
Gleditsia aquatica, 1
 texana, 99, 287
Gordonia, 186, 252
Grapefruit, 100

Halesia carolina, 122, 257

- diptera, 257
 parviflora, 237
 tetraptera, 237
 Hamamelis, 6, 8, 12, 16, 220, 221, 222
 macrophylla, 222, 225
 vernalis 12, 218, 222
 var. parvifolia, 16
 virginiana, 218, 219, 221, 222
 Haw, May-, 241
 Hibiscus mutabilis, 52
 Hickory, 38, 48, 55, 57, 60, 67, 71, 73, 74,
 80, 86, 98, 109, 117, 127, 132, 139, 295
 Nutmeg, 175
 Holly, 37
 Huckleberry, 243
 Hydrangea, 36
 quercifolia, 30
 Hypericum lobocarpum, 289
 Ilex, 270
 amelanchier, 52, 271
 cassine (dahoon), 145, 269
 var. myrtifolia, 145
 dahoon, 145
 longipes, 36, 37, 209, 271
 lucida, 145, 209, 262
 monticola, 44, 46, 209
 Illicium, 111
 Jasminum sambac, 276, 277
 Juniperus taxifolia, 252, 284
 Kalmia latifolia, 144
 Lemon, ichang, 101, 105
 Leucothoë axillaris, 176
 racemosa, 209
 Ligustrum, 45, 259
 coriaceum, 263
 japonicum, 263
 lucidum, 258
 Lime, Ogechee, 249
 Lindens, 56, 60, 71, 93, 98, 126, 128, 137,
 150, 153, 172
 Rough barked, 134
 Smooth barked, 134
 Lindera, 8
 Liriodendron, 86
 Liquidambar, 14
 Magnolia, 113
 acuminata, 84, 113
 var. ludoviciana, 196
 cordata, 101, 105, 113
 foetida, 58
 fraseri, 264
 glauc, 128, 196, 198, 199
 grandiflora, 58
 virginiana var. australis, 196, 199
 Malus, 13, 20, 22, 23, 25, 27, 113, 121
 angustifolia, 13, 20, 30, 32, 34, 103,
 113, 120, 121, 264
 coronaria, 34, 264
 var. puberula, 34, 36, 38
 fragrans, 50
 ioensis, 82, 113, 121
 var. creniserrata, 32, 34, 77, 104, 110,
 162
 var. palmeri, 30, 34, 38, 50, 78, 103,
 104, 110
 platycarpa, 82
 Maple, 28, 29, 36
 Red, 195
 Silver, 254
 Sugar, 28
 Mesquite, 1
 Mimosa strigulosa, 31
 Mulberry, 216
 Myrica, 209, 215, 220
 inodora, 204, 265
 Nyssa, ogechee, 249, 252
 Oak, 99, 109, 124, 127, 132, 144, 146,
 148, 150, 153, 295, 297, 299
 dwarf, 97, 99, 153
 laurel, 153
 lucombe, 14
 post, 38, 86, 97, 99, 109, 127, 128, 153,
 161
 red, 109
 scarlet, 81, 89
 water, 99
 white, 92, 97
 Orange, 100, 105
 Ichang, 101
 Osage Orange, 264
 Oxydendrum, 264, 290
 Parkinsonia aculeata, 31
 Paulownia Mikado, 217
 Persea borbonia, 46
 palustris, 82
 Persimmon, 5, 9, 10, 250
 Philadelphus, 181
 grandiflorus, 183, 285, 286
 inodorus, 183
 Picea, 252
 Pieris nitida, 209
 Pignut, 45, 55
 Pinus, 252
 caribaea, 133, 144
 glabra, 58, 62, 144
 luchuensis, 217
 palustris, 287, 288
 sonderegeri, 287
 taeda, 287, 288
 Platanus, 192
 Plum, 7, 8, 10, 11, 17, 22, 24, 25, 37, 38,

- 39, 40, 41, 55, 71, 81, 86, 89, 94, 97
 Big tree, 65
 Chickasaw, 38
Prunus, 13, 15, 18, 20, 23, 25, 64, 228
 americana, 5, 64, 81, 245
 angustifolia, 64, 66, 228, 244
 var. *varians*, 228, 244, 245
 arkansana, 64, 67, 215
 caroliniana, 245, 246
 coccinea, 64
 cocksii, 244
 lanata, 245
 mexicana, 64, 67, 215, 245
 mitis, 41
 munsoniana, 31, 41, 64, 244
 pennsylvanica, 41
 reticulata, 64, 67
 tarda, 64
 umbellata, 41, 65, 215, 245
 watsoni, 40
Ptelea rhombifolia, 88
 trifoliata, 88
 var. *mollis* 273
Pyracantha crenulata, 119
Pyrus arbutifolia var. *macrophylla*, 230
Quercus, 38, 120, 125, 127, 152, 156, 157, 252
 acuminata, 58
 alba, 87, 153
 var. *repanda*, 143
 ambigua, 108
 austrina, 81, 87, 89, 92, 93, 99, 107, 108, 120, 124, 125, 127, 128
 borealis, 108, 159, 164
 brevifolia, 52, 112
 breviloba, 30, 111
 bushii, 157
 catesbaei, 157, 159, 163
 cerris, 14
 cinerea, 106, 159, 161
 coccinea, 86, 87, 89, 95, 107, 108, 277
 var. *tuberculata* 161
 cocksii, 163, 185, 215
 comptonae, 161
 durandii, 81, 93, 96, 97, 99, 107, 108, 111, 120, 124, 127, 128, 130
 eximia, 177
 falcata, 107, 159
 geminata, 152
 glauca, 162
 hybrida, 93
 imbricaria, 93, 99, 154
 laurifolia, 31, 151, 155, 156, 158, 160, 161, 162, 163, 176
 ludoviciana, 38, 110
 lyrata, 156, 159, 161
 margaretta, 153
 marilandica, 154, 157, 159, 163
 michauxii, 159
 muhlenbergii, 58
 myrtifolia, 152, 167
 nigra, 87, 97, 151, 154, 157, 158
 var. *rhombifolia*, 153
 var. *tridentifera*, 161
 pachyloma, 217
 pagodaefolia, 87, 158, 161
 phellos, 158
 pinus, 159
 repanda, 152
 rhombica, 161
 rhombifolia, 151, 156, 157, 158, 161
 rubra, 89, 107, 109, 111, 159, 161
 var. *leucophylla*, 158, 161
 var. *triloba*, 161
 schneckii, 161
 shumardii, 109, 111, 112, 115, 120, 161, 167
 var. *schneckii*, 167
 stellata, 97, 161
 var. *araniosa*, 161
 var. *margaretta*, 52, 161, 176
 forma *stolonifera*, 153, 161, 176
 var. *paludosa*, 161
 suber, 14
 subintegra, 161, 188
 texana, 107, 109, 111, 112, 113, 115, 161, 167
 tomentosa, 108
 velutina, 86, 97, 99, 108, 121, 157, 161
 var. *missouriensis*, 97, 121, 161
 virginiana 118, 143, 152, 153, 156, 159, 161, 280, 289
 var. *eximia*, 161
 var. *geminata*, 161
 var. *lyrata*, 155
 walteriana, 157
Raphidophyllum hystrix, 297
Rhododendron, 286
 canescens, 242, 254
 chapmanii, 284
 nudiflorum, 242
 oblongifolium, 254, 285
 serrulatum, 254
Rhus glabra, 62, 262
 toxicodendron, 273
Ribes, 285
Rosa hugonis, 219, 226, 227
 humilis, 52, 268
 lyonii, 268
 treleasei, 286
 Rose, 274
 Rose of Sharon, 45
Rubus, 52
 andrewsianus, 19, 20, 53

- argutus, 20
 carpinifolius, 273, 286
 floridus, 273
 rosaefolius var. coronarius, 261
 trivialis, 20, 53
 Rutaceae, 286
 Salix, 5, 10, 66
 longipes, 189
 var. venulosa, 189
 nigra, 5, 16, 255
 var. altissima, 13
 Sambucus, 18
 canadensis, 45, 262
 var. submollis, 45
 simpsonii, 45
 Sapindus drummondii, 4, 263
 Sargentodoxa cuneata, 132
 Sassafras variifolium var. albidum, 54
 Slippery elm, 91
 Smilax, 82
 lanceolata, 4, 82
 Sorbus americana, 254
 Styrax, 242
 Taiwania, 249, 252
 Taxodium, 62
 Tilia, 14, 58, 81, 82, 83, 85, 86, 87, 89, 94,
 114, 116, 120, 123, 124, 125, 126, 127,
 129, 134, 138, 141, 146, 161, 164, 165,
 176, 180, 182, 184, 186
 ambigua, 134, 137, 138, 146
 americana, 2, 58, 59, 61, 94, 114, 126,
 135, 137, 164
 amphiloba, 138
 brevipedunculata, 138
 caroliniana, 138
 cheiophila, 138
 cocksii, 134, 136, 137, 138, 146
 crenoserrata, 138
 floridana, 11, 114, 120, 127, 134, 137,
 138, 277
 var. oblongifolia, 135, 137
 georgiana, 138
 glabra, 138, 164, 188
 grosseserrata, 138
 harbisonii, 135, 138
 heterophylla, 58, 114, 120, 135, 138, 164
 leptophylla, 2, 18, 58, 60, 120, 134
 littoralis, 138
 michauxii, 61, 114
 monticola, 138
 neglecta, 138
 nivea, 138
 nuda, 135, 137, 138, 164, 167, 188
 var. glaucescens, 137
 phanera, 138
 pubescens, 56, 93, 114, 134
 rhoophila, 137, 138, 146
 texana, 138
 tomentosa, 93
 trichoclada 138
 Torreya, 252
 Ulmus americana, 255
 fulva, 91, 213
 Vaccinium, 9, 27
 arboreum var. glaucescens, 262
 atrococcum, 212
 corymbosum, 274, 275
 var. fuscatum, 274
 elliottii, 9, 52, 187
 fuscata, 274
 glaucescens, 9
 melanocarpum, 220
 myrsinites, 274
 stamineum, 9, 20, 52
 tenellum, 187, 212, 274
 vacillans, 9
 vegetum, 274
 virgatum, 52, 275
 Viburnum, 259
 acerifolium, 30
 dentatum, 18
 molle, 18
 odoratissimum, 261
 prunifolium, 46, 262
 pubescens, 18, 20, 286
 rufidulum, 46, 262
 scabrellum, 20, 52, 271, 286
 Vitis aestivalis, 44, 140
 canescens, 19, 20
 caribaea, 140
 cinerea, 20
 cordifolia, 20, 44
 labrusca, 19
 palmata, 141
 rufotomentosa, 140
 rupestris, 141
 Walnut, Bitter, 175
 Willow, 9, 11, 14, 161
 black, 11, 13
 Wisteria frutescens, 38
 macrostachya, 38
 Witch hazel, 14, 223
 Zanthoxylum 254
 clava-herculis, 248
 Zizyphus sativa, 53
 vulgaris, 53
 DEPARTMENT OF BOTANY,
 TULANE UNIVERSITY,
 NEW ORLEANS 18,
 LOUISIANA

COMPARATIVE ANATOMY OF THE LEAF-BEARING
CACTACEAE, XIVPRELIMINARY OBSERVATIONS ON THE VASCULATURE OF
COTYLEDONSI. W. BAILEY¹

A CONSENSUS OF ANATOMICAL EVIDENCE presented in preceding papers of this series clearly indicates that the most primitive and structurally least specialized surviving representatives of the Cactaceae occur in the genus *Pereskia*. Such better known species as *P. sacharosa* Griseb., *P. bleo* DC. and *P. grandifolia* Haw. have long been recognized by various taxonomists as having a habit of growth and absence of accentuated succulence characteristic of many typically woody dicotyledonous trees and large shrubs. These species in contrast to other representatives of the Cactaceae exhibit only slight evidence of incipient trends of divergent structural specializations internally (Bailey, 1962, 1963c). The comparatively thin large leaves of adult plants have typical pinnate venation, their numerous lateral veins extending diagonally toward the margins of the lamina (FIG. 1).

Pereskias of such other species as *P. aculeata* Mill. (Bailey, 1962), *P. humboldtii* Britt. & Rose, *P. weberiana* K. Schum., *P. diaz-romeroana* Cárdenas (Bailey, 1963a) and *P. guamacho* Web., *P. colombiana* Britt. & Rose, *P. cubensis* Britt. & Rose, and *P. portulacifolia* Haw. (Bailey, 1963d), although exhibiting variations in stature and habit of growth, as well as more or less incipient internal trends of divergent anatomical specializations, have leaves with pinnate venation (Bailey, 1960).

Many of the leaves of these taxa, with the possible exception of those of *P. aculeata* and *P. cubensis*, tend at times to form more extensively arcuate lateral veins (FIG. 2). Particularly in some leaves of *P. humboldtii* and related taxa of Peru and Bolivia, and in some aberrant ones of *P. guamacho* and *P. colombiana*, modifications of pinnate vasculature occur. In such leaves the lateral veins which diverge from the midvein in the basal and central part of the lamina become more conspicuous and extensively arcuate with concomitant reduction of those in the apical parts of the leaf (FIG. 3). These modifications of pinnate vasculature appear phylogenetically to be transitional toward the pseudopalmate and palmate venation which occurs in the comparatively thick succulent leaves of the structurally more highly specialized genera *Pereskioopsis* and *Quiabentia* (FIGS. 4, 5).

The leaves of *Pereskia pititache* Karw. (*P. conzattii* Britt. & Rose), *P. autumnalis* (Eichlam) Rose, and *P. nicoyana* Web. are particularly significant in these connections. Not only are they more succulent than those of *P. sacharosa*, *P. bleo*, and *P. grandifolia*, but also vary markedly in size

¹ This investigation was financed by a grant from the National Science Foundation.

and form (Bailey, 1960). In some of them, the venation is of the modified pinnate form discussed in the preceding paragraph whereas in others the vasculature becomes truly pseudo-palmate and even closely palmate.

In the dicotyledons as a whole changes in patterns of foliar vasculature are not consistently unidirectional. Transitions from pinnate to palmate venation and vice versa are of not uncommon occurrence. Suggestive conclusions regarding phylogenetic changes in vasculature within a specific family therefore, are dependent upon extensive summations of cumulative circumstantial evidence. In the genera *Pereskia*, *Pereskiopsis*, and *Quiabentia*, a totality of evidence now available is strongly indicative of a phylogenetic transition from pinnate venation in structurally primitive pereskias to palmate vasculature in anatomically more highly specialized surviving representatives of *Pereskiopsis* and *Quiabentia* (Bailey, 1964a).

In his extensive survey of seeds, embryos, and seedlings, Ganong (1898) concluded that the Cactaceae is a family in which succulence and other adaptations for survival in excessively arid environments work backward phylogenetically into earlier and earlier stages of the development of the epicotyl, there commonly being conspicuous retardation in the appearance of such divergent changes in the cotyledons and hypocotyl of germinated embryos at least prior to growth of the plumule. If this retardation of evolutionary changes in cotyledons of the Cactaceae is as general as it appears to be, it is of possible significance to compare the cotyledonary vasculature in *Pereskia* with that in *Pereskiopsis* and *Quiabentia*. Of course it should be fully recognized in this connection that ontogeny does not closely parallel phylogeny in many cases. However, as recognized by Ganong, the divergent trends of specialization in the Cactaceae are so bizarre and so closely correlated from ecological and physiological points of view with adaptations for survival in arid environments as to leave few uncertainties regarding the directions in which phylogenetic changes are progressing. Furthermore, the Cactaceae is a family in which transitional stages of phylogenetic changes are more consistently and adequately preserved in surviving representatives than is commonly the case in many other families of the dicotyledons.

Thus far, I have been able to obtain seedlings of the following species through the kind assistance of Dr. Boke and other botanists.

Pereskia aculeata — Boke: from seeds collected by him.

Pereskia sacharosa — Boke: from seeds collected by Castellanos.

Pereskia grandifolia — Boke: from seeds collected by Steyermark.

Pereskia diaz-romeroana — Boke: from seeds collected by Cárdenas.

Pereskia humboldtii — Hutchinson #1452.

Pereskia pititache — Boke: from seeds collected and germinated by him.

Pereskia autumnalis — Moore #8210.

Pereskiopsis blakeana — Kimnach #82.

Pereskiopsis porteri — Kimnach #76.

Pereskiopsis — Boke: from seeds collected by MacDougal near Oaxaca.

Pereskiopsis — Boke B-5: from seeds collected at Totolapan, Oaxaca.

Pereskiopsis — Boke B-27: from seeds collected at Totolapan, Oaxaca.

In my paper on "Nodal anatomy in retrospect" (1956), I presented the results of an extensive reconnaissance of seedlings from 99 families of the dicotyledons. In 60 per cent of them the cotyledons are attached at 2-trace unilacunar nodes. Within this category there is a tendency at times in some families for the cotyledons to be pinnately veined (FIG. 9). In the structurally most primitive pereskias, viz. *P. sacharosa* and *P. grandifolia* which have pinnate venation in the leaves of both juvenile and adult plants, the cotyledons have this 2-trace pinnate form of vasculature. Therefore a totality of evidence suggests that the cotyledons of ancestral Cactaceae possessed pinnate venation during early stages of the differentiation of the family.

In the case of *P. sacharosa* and *P. grandifolia*, the thin oblong-elliptical or slightly ovate cotyledons, which are relatively small in seeds, continue to enlarge and appear to be physiologically functional for considerable time during earlier stages of the development of the juvenile plant, i.e., for a period which may be as extensive as several months. During the expansion of the cotyledons they retain their original form and internal pinnate venation. Particularly during the earliest stages of the enlargement of the cotyledons, the two traces commonly tend to be distinct and separate in the upper hypocotyl, at the nodal level, and in the basal part of the lamina (FIGS. 10, 12). During later stages of the enlargement of the cotyledons the xylems of the two traces tend to broaden and to become more or less closely approximated (FIGS. 11, 13). During such changes in the two traces, approximation of the two strands of phloem may be much less precocious than in the xylems.

The cotyledons in the large seeds of *P. aculeata* and of germinated embryos prior to development of the epicotyl are larger than those that occur in other representatives of the Cactaceae. These thin broadly ovate or slightly cordate cotyledons have a 2-trace pinnate form of vasculature (FIG. 14). The basal lateral veins are not extensively arcuate, thus resembling in this respect the venation in cotyledons of *P. sacharosa* and *P. grandifolia*.

In contrast to this the cotyledons in seeds of *P. diaz-romeroana* and *P. humboldtii* and of germinated embryos prior to the development of the epicotyl are much smaller than those of *P. aculeata* and are of more nearly oblong rather than ovate form. In my few seedlings of *P. diaz-romeroana*, the cotyledons have a simplified form of pinnate venation without conspicuous accentuation of the lateral veins (FIG. 17), whereas in those of *P. humboldtii* the cotyledons exhibit a tendency at times to accentuate the more extensively arcuate basal lateral veins (FIG. 16). It should be mentioned in this connection that the pereskias of Peru and Bolivia are much reduced in stature and commonly have very small leaves. This may be a factor in the simplified venation of early deciduous cotyledons of *P. diaz-romeroana*.

Pereskia pititache of which I have numerous seedlings has oblong-elliptical cotyledons with pinnate venation, but with a tendency to form extensively arcuate lateral veins (FIG. 15). However, they do not exhibit

transitions to truly pseudo-palmate vasculature such as occurs in the leaves of juvenile and adult plants. The cotyledons of the closely allied taxon, *P. autumnalis*, have similar somewhat modified pinnate venation.

The leaves of *Pereskioopsis* are very variable in size and form, not only in different collections of a taxon or clone when grown under different environmental influences, but frequently also in different parts of a single adult plant. Excessive emphasis by earlier taxonomists upon apparent differences in the form of leaves, when limited collections were available, has led to serious difficulties and uncertainties in identifying the numerous putative species of the genus. However, the leaves of adult *Pereskioopsis*, regardless of extreme variations in size and form and concomitant taxonomic uncertainties are comparatively succulent and consistently pseudo-palmately or palmately veined (FIGS. 4, 5). This is true except for the small first-formed leaves of some short shoots which may at times exhibit transitions from modified pinnate venation (FIG. 8) to palmate vasculature.

In seedlings of *Pereskioopsis porteri* (T. S. Brandeg.) Britt. & Rose, *P. blakeana* Ort., and three collections from Oaxaca of uncertain taxonomic affinities, the nearly oblong-elliptical cotyledons have a 2-trace pinnate form of vasculature (FIG. 18). At times the lateral veins which diverge from the mid-vein in basal and central parts of the lamina become accentuated in their arcuate extensions (FIGS. 19, 20), thus resembling in this respect the venation in cotyledons of *Pereskia pititache* and *P. humboldtii*.

The first-formed leaves of juvenile plants from these seed collections commonly vary more or less markedly in size and form. At times the ontogenetic sequences are complicated by the occurrence of rudimentary evanescent appendages with abnormal vasculature. Frequently the normal first-formed leaves differ strikingly from those of adult plants, tending to be narrowly lanceolate with fewer extensively arcuate lateral veins (FIG. 7) in contrast to the broader leaves of adult plants (FIG. 5). Not infrequently there is obvious ontogenetic retardation in the attainment of palmate venation; the first leaves of the juvenile stem having modified pinnate venation (FIG. 6) rather than truly palmate vasculature.

Thus, in agreement with work of Ganong (1898), the retardation in the attainment of pseudo-palmate and palmate venation in cotyledons of *Pereskioopsis* as well as in those of *Pereskia pititache* and *Pereskia humboldtii* strengthens a concept of divergent evolutionary change from pinnate to palmate venation in the Cactaceae. For, if the reverse were true, one would expect to find palmate venation in the leaves of the most primitive surviving representatives of the family and at least some cotyledons which retain palmate vasculature.

CONCLUSIONS

The Cactaceae is a family which provides unusually favorable evidence for the study of highly divergent trends of morphological specialization. These are so bizarre and so closely correlated from ecological and physiological points of view with adaptations for survival in arid environments

as to leave few uncertainties regarding the directions in which phylogenetic changes are progressing. Furthermore, an unusually comprehensive and adequate record of the divergent trends of specialization is preserved in surviving representatives of the family.

A totality of available evidence strongly indicates that ancestral Cactaceae had attained an advanced level of anatomical structure in their cambium, xylem, phloem, and cotyledons prior to the development of accentuated succulence and other trends of excessively divergent anatomical specializations (Bailey & Srivastava, 1962; Srivastava & Bailey, 1962). The ancestral trees and large shrubs of normal woody structure appear to have borne relatively broad thin leaves rather than succulent terete ones as in surviving representatives of the Opuntieae. The ancestral leaves evidently possessed typical pinnate venation and stomata of the "true rubiaceous" form (Bailey, 1964b). The germinated embryos, at least prior to the development of the epicotyl, had 2-trace unilacunar vasculature and both the cotyledons and first-formed leaves exhibited pinnate venation.

Evidence of a phylogenetic transition from pinnate to palmate venation in the relatively succulent leaves of *Pereskia pititache*, *P. autumnalis*, *P. nicoyana*, *Pereskiopsis*, and *Quiabentia* is now available. In this connection, retardation in the extension of palmate venation into cotyledons of *Pereskia* and *Pereskiopsis* as well as in the first-formed leaves of the latter genus provides corroborative evidence of considerable significance regarding a phylogenetic transition from pinnate to palmate vasculature in the Cactaceae.

It should be noted in conclusion that summations of evidence available in the most primitive surviving representatives of the Cactaceae suggest that ancestral members of the family may have possessed spines and hairy areoles during earlier stages of their differentiation as a family. More significant from physiological and biochemical points of view appear to be the likelihood that ancestral Cactaceae possessed abundant mucilage cells and an incipient tendency in their metabolism toward the formation of unusually abundant crystals of calcium oxalate and other calcium salts of organic acids (Bailey, 1965). Furthermore there appears to have been an incipient tendency toward the storage of unusually abundant starch in the secondary xylem of the main stem and the larger roots of mature plants, and likewise at times for the accumulation of large amounts of stored protein.

LITERATURE CITED

- BAILEY, I. W. 1956. Nodal anatomy in retrospect. *Jour. Arnold Arb.* 37: 269-287.
- . 1960. Comparative anatomy of the leaf-bearing Cactaceae, I. Foliar vasculature of *Pereskia*, *Pereskiopsis* and *Quiabentia*. *Ibid.* 41: 341-356.
- . 1962. VI. The xylem of *Pereskia sacharosa* and *Pereskia aculeata*. *Ibid.* 43: 376-388.
- . 1963a. VII. The xylem of pereskias from Peru and Bolivia. *Ibid.* 44: 127-137.

- . 1963b. VIII. The xylem of pereskias from southern Mexico and Central America. *Ibid.* 211–221.
- . 1963c. IX. The xylem of *Pereskia grandifolia* and *Pereskia bleo*. *Ibid.* 222–231.
- . 1963d. X. The xylem of *Pereskia colombiana*, *Pereskia guamacho*, *Pereskia cubensis* and *Pereskia portulacifolia*. *Ibid.* 390–401.
- . 1964a. XI. The xylem of *Pereskiopsis* and *Quiabentia*. *Ibid.* 45: 140–157.
- . 1964b. XII. Preliminary observations upon the structure of the epidermis, stomata, and cuticle. *Ibid.* 374–389.
- . 1965. XIII. The occurrence of water-soluble anisotropic bodies in air-dried and alcohol-dehydrated leaves of *Pereskia* and *Pereskiopsis*. *Ibid.* 46: 74–85.
- & L. M. SRIVASTAVA. 1962. Comparative anatomy of the leaf-bearing Cactaceae, IV. The fusiform initials of the cambium and the form and structure of their derivatives. *Ibid.* 43: 187–202.
- GANONG, W. F. 1898. Contributions to a knowledge of the morphology and ecology of the Cactaceae, II. The comparative morphology of the embryos and seedlings. *Ann. Bot.* 12: 423–474.
- SRIVASTAVA, L. M. & I. W. BAILEY. 1962. The comparative anatomy of the leaf-bearing Cactaceae, V. The secondary phloem. *Jour. Arnold Arb.* 43: 234–278.

EXPLANATION OF PLATES

PLATE I

FIGS. 1–8. Leaves of *Pereskia* and *Pereskiopsis* showing midvein and principal lateral veins. Finer details of vasculature omitted except in FIG. 6. Actual size of leaves variously reduced and enlarged. 1, Form of vasculature in most primitive category of pereskias. 2, Pinnate venation with extensively arcuate lateral veins. 3, Modified pinnate venation with accentuation of arcuate lateral veins diverging from midvein in basal and central part of the lamina. 4, Pseudo-palmate venation. 5, Palmate venation. 6, Modified pinnate venation in lanceolate leaf of juvenile stem of *Pereskiopsis* [Boke B-5]. 7, Pseudo-palmate venation in lanceolate leaf of juvenile stem of *Pereskiopsis* [Boke B-27], compare with FIG. 5 for form and venation in leaf from adult plant. 8, Modified pinnate venation in first-formed leaf of short shoot of *Pereskiopsis blakeana* [Boke B-33]. Drawn by Elmer W. Smith.

PLATE II

FIGS. 9–20. Cotyledons of *Pereskia* and *Pereskiopsis* comparably enlarged to approximately $\times 1.7$. Finer details of venation omitted except in FIG. 17. 9, Diagrammatic illustration of pinnately veined cotyledon attached at a 2-trace unilacunar node. 10, *Pereskia sacharosa* cotyledon prior to the development of the juvenile stem. 11, *The same*, during final stage of its enlargement. 12, *Pereskia grandifolia* prior to the development of the juvenile stem. 13, *The same*, during final stage of enlargement. 14, *Pereskia aculeata*, cotyledon prior to the development of the juvenile stem. 15, *Pereskia pititache*, cotyledon with modified pinnate vasculature. 16, *Pereskia humboldtii*, cotyledon with modified pinnate venation. 17, *Pereskia diaz-romeroana* cotyledon with entire venation. 18, *Pereskiopsis* [Boke B-5] cotyledon with normal pinnate venation. 19, *Pereskiopsis blakeana*, cotyledon with basally modified pinnate venation. 20, *Pereskiopsis porteri*, cotyledon with basally slightly modified pinnate venation. Drawn by Elmer W. Smith.